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Designing and implementing conservation tender metrics: Twelve core considerations

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ABSTRACT

In conservation tenders metrics are intended to describe the values that would result from alternate investments; they are the linkage between individual on-ground projects and tender scheme proponents. These metrics have received little attention by economists yet are the critical linchpin that defines the nature of the values that are traded in markets. In this paper we identify twelve lessons that can guide practitioners in metric design. These lessons embrace the principal biophysical changes likely to result from management change at each site and in combination, and reflect the values that society places on the outcomes from these changes. Practical application is explored through four example tenders encompassing five metrics which demonstrate substantial variation from the lessons identified. The practical consequences for cost-efficiency of investment, and for the use of conservation tenders generally, are unclear because of the practical and political difficulties in developing effective conservation tender approaches.

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1. Introduction

Over the last thirty years there has been increasing focus on market-based mechanisms for delivering environmental benefits. These mechanisms focus on using prices to signal and incentivize agents, usually landholders, to manage resources under their stewardship in order to protect or enhance the environmental values they generate. Mechanisms employed span conservation tenders or auctions, offset mechanisms, payment for ecosystem service (PES) schemes and others. Most of these market-based mechanisms with any claim to efficient allocation of scarce funds employ a metric to translate the quantity of environmental value provided into a commodity unit or score. Metrics in environmental markets are the critical connection between the desired outcome and the strength of the market signal provided (Boyd and Banzhaf, 2007 #1954; Salzman and Ruhl, 2000 #1426). The metric is defined as the composition of the common comparison unit applied across individual's project proposals. As such the metric commodifies the environmental value offered, allowing comparison between different bundles of environmental benefits being offered in the market and provides the critical role of fungibility in environmental markets (Salzman and Ruhl, 2000). A consistently quantified unit of investment value allows potential purchasers to compare the benefits that they will receive from alternative offers of supply.

The objective in this paper is to offer some guidance to planners and others contemplating environmental markets, and in particular conservation tenders. To do this I draw on conservation planning, economics and PES literatures to identify twelve design lessons to inform metric design and integration into conservation tenders. I illustrate these lessons through examples from four large scale, repeated tenders encompassing five metric forms. Differences between these metrics can only be partly explained by cost-efficiency considerations with a combination of pragmatic implementation trade-offs and other factors contributing to further elements and indicating the practical issues encountered in such markets. This paper is the first to directly address the elements of metric design in a form that presents consolidated lessons to support policy makers and researchers considering metric design in conservation tenders. These lessons are important as construction and implementation of metrics is potentially costly, yet likely to be important to market performance. There is a general consensus that cost-efficient targeting, maximizing benefits subject to a budget constraint, offers the most desirable form of targeting in payment for ecosystem service approaches such as conservation tenders

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(Duke et al., 2013; Ferraro, 2003; Zabel and Roe, 2009). Authors have also argued the need for cost-efficient targeting to include risk (Moilanen et al., 2009), spatial interactions and thresholds (Wu and Boggess, 1999; Wu et al., 2001), or the potential for outcome-based metrics (Zabel and Roe, 2009). In practice environmental markets have incorporated a wide range of prioritization approaches, including specific environmental benefit metrics, applied in different applications which are often argued to deliver cost-efficient targeting.

Conservation tenders are a relatively specialized form of environmental markets which use a reverse auction to overcome information asymmetries between buyers and sellers (Latacz-Lohmann and Van der Hamsvoort, 1998). Landholders are likely to know more about production costs and opportunities (Latacz-Lohmann and Van der Hamsvoort, 1998), and may also have knowledge about the potential environmental benefits that is difficult or costly to observe. Governments or other purchasers hold knowledge about their relative preference for environmental outcomes (Stoneham et al., 2003). In conservation tenders buyers rank the bids submitted, which are intended to overcome assumed asymmetric information about production and opportunity costs, in order of preference by applying some form of prioritization metric intended to incorporate relative environmental outcomes. The focus in this paper is on formalized metrics, of which examples include the environmental benefits indexes applied within the Conservation Reserve Program in the United States (Cattaneo et al., 2006; Ribaudo et al., 2001; SWCS et al., 2008), differing iterations of the conservation value scores applied in the Australian Government Environmental Stewardship Scheme (Whitten et al., 2010), and variations on the habitat hectares scoring system applied in BushTender and BushBroker in Victoria, Australia (Parkes et al., 2003). These approaches embody three differing approaches to benefit estimation in metrics – biodiversity condition or quality adjusted indices, multicriteria indices and expected value indices, as well as other differences in treatment of costs and prioritization approaches.

The paper is structured as follows. The cost-efficient conservation planning literature in economics and to a lesser extent ecological literature is explored in Section 2, including as it relates to PES approaches. In section three twelve lessons informing metric design are distilled from the conservation planning literature in the context of conservation tenders, along with economic literature informing agri-environmental schemes. Five conservation tender metrics arising from four example tenders are used in this section to illustrate the variability of metrics in practice and some consequences for metric efficiency. A brief discussion of the overall importance of the design lessons and observations on practical implementation through the example tenders completes the paper.

2. Prioritization literature and conservation tender metrics

What constitutes an appropriate measure for prioritizing conservation investments has been a recurring theme over the last thirty years at least in the environmental economics and conservation management literature. All prioritization literature effectively relies on the argument that some form of heterogeneity in environmental benefits is present, and leveraging that heterogeneity offers the potential to extract greater environmental benefits from the limited resources available. To date there appear to have been three largely separate, though conceptually overlapping strands of prioritization research: cost-effectiveness analysis and other contributions from the economics discipline; biodiversity prioritization literature; and benefit index construction theory and practice. Before focusing on the common lessons for environmental benefit[1] prioritization generally, each of these strands is briefly explored in the remainder of this section.

The study of economics has at its center the allocation of scarce resources amongst competing needs, and research in this domain has focused on the allocation of scarce economic resources amongst competing conservation demands. Amongst the first to consider the implications in an environmental context were Babcock et al. (1997) who articulated four potential project regions in a high/low cost and environmental benefit distribution. Targeting according to either benefits or costs alone in this setting is likely to be inferior to joint targeting. Later writers refined these concepts into four broad prioritization options (Duke et al., 2013; Ferraro, 2003; Wu, 2004):

- Benefit targeting: identifying and purchasing offers in order of greatest environmental benefits per project, or sometimes per unit area.
- Cost targeting: identifying and purchasing the cheapest offers, usually per unit area.
- Benefit-cost targeting and variations: target projects in order of benefit-cost ratios until the budget is exhausted. Variations may include cost as an element of a benefit index as is the case with the CRP for example.
- Cost-efficient targeting: accounts for additional factors as relevant and may include factors such as additionality (Maron et al., 2013), risk (Moilanen et al., 2009), and slippage (Wu, 2000). Duke et al. (2013) suggest that cost-efficient targeting can be further refined using optimization techniques to accommodate thresholds (Wu, 2004; Wu and Boggess, 1999), multiple goals, and project package optimization to avoid budget remainders.

There has been some evaluation of the efficiency gains from applying what are argued to be cost-efficient approaches when compared to either no targeting or various other targeting approaches (Claassen et al., 2008; Connor et al., 2008; Feather and Hellerstein, 1997; Ferraro, 2003; Kirwan et al. 2005; Stoneham et al., 2003). The consensus conclusion indicates there are significant social welfare gains available from employing a targeting approach in the presence of heterogeneity of costs and benefits (Babcock et al., 1996; Babcock et al., 1997; Duke et al., 2013; Ferraro, 2003). The concept is visually illustrated in Fig. 1 using an example Lorenz curve. The greater the distance between lines 'A' and 'B' in Fig. 1, the greater the impacts of heterogeneity in the cost of delivering environmental benefits and the greater the potential increase in benefits from applying cost-efficient targeting. A line such as 'C' in Fig. 1 represents a potential prioritization option. Practical prioritization options will always lie inside the unattainable perfectly cost-efficient allocation (line 'A') (Kroeger, 2013). The closer a metric option such as line 'C' to line 'A', the closer to cost-efficient targeting the metric delivers. The greater the distance of line 'C' from line 'B' the greater the efficiency gains from employing a more sophisticated metric over a non-targeted approach.[2] For example, in Fig. 1 with 50% of the budget allocated one could deliver between 50% (line 'B') and approximately 80% (Line 'A') of the total possible environmental benefits available depending on the metric applied (see Ferraro, 2003 for a practical example).

A key question obviously arises as to how environmental benefits may be measured for inclusion in any cost-efficient targeting approach. One option is to draw on biodiversity measurement and

[1] The term environmental benefits is used as a generalisation of the tender objective to avoid confusing biodiversity and ecosystem service concepts.

[2] Correlation between a cost-efficient metric score and area, forest cover or some other simple measure introduces the potential for relatively simple options that will lie between 'B' and 'C'. As illustrated in Fig. 1 the scale of efficiency gain may also be related to the budget allocated.

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